Automated Tools and Technologies for Enhancing Long-Range Imagery, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

One of the mandates of NASA's Armstrong Flight Research Center (AFRC) is participating in the flight testing of experimental aircraft, which includes monitoring these tests with long-range, ground-based cameras. Because these cameras track and capture flight tests occurring multiple kilometers away, the imagery collected is often degraded by the atmospheric turbulence between the camera and subject. In the summer of 2015, EM Photonics delivered the ATCOM TM-1, a rack-mountable system that is capable of taking a live HD-SDI video from a NASA long-range tracking camera, enhancing that video in real time, and outputting the resulting video in the same format; however, the current approach still requires user configuration to achieve the best results. The focus of our work in this project will be on both automating system configuration to adjust automatically to changing system and scene parameters, as well as improving human factors related to operator's use of an inline video processing solution. The former requires research on methods for estimating turbulence and determining motion in complex videos with significant distortion and warping. In the course of this project, we will develop technology in four primary areas, each of which are useful in themselves but with the ultimate goal of including them as features in the ATCOM TM-1 system currently used by NASA AFRC.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Our work will be broadly applicable to any group that collects long-range imagery for monitoring, scientific study, or surveillance applications. At NASA, this includes groups that track flight tests and rocket launches as well as those looking from ground-based cameras to observe astronomical phenomena. The primary application of this technology is to the flight test and tracking work done at Armstrong Flight Research Center (AFRC). These tools will

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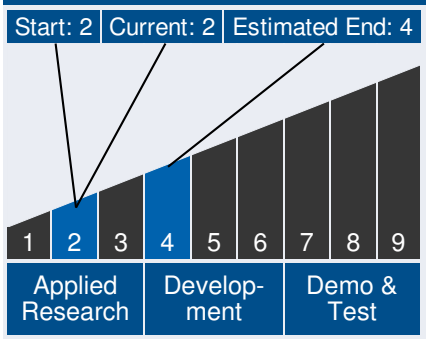
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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provide further enhancement of videos collected there allowing for observation of additional detail in the subjects imaged. It will also include software to automate the current image enhancement system, reducing the burden on the operator of interacting with it and thus freeing them up to focus on their other responsibilities during flight tests. The image enhancement tools developed here can be used in two ways during rocket launches. First, since observation cameras must be placed far from the launch pads, our technology can assist in range clearance to allow for observation of additional details on vehicles prior to launch. Second, they will provide additional detail on rockets as they fly to provide more information to ground crew. Additionally, the software we develop can also be used in the study of objects in space from ground cameras. We can mitigate the atmospheric effects given a clear picture of objects of interest.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The technology developed in this project will have applications at other federal government agencies as well as in the private sector. From a federal government perspective, these tools can be used to monitor secure facilities including sensitive government buildings and nuclear stockpiles. Our technology can reveal additional details on the subjects being monitored. They can increase the effective range of cameras placed at the border. Customs and Border Patrol has shown an interest in this technology for helping catch drug traffickers. Local government and regulatory agencies may also be interested in in monitoring wildlife around power-generation facilities including solar farms and land and sea-based wind turbines, primarily for their effects on local bird and other animal habitats. Within private industry, we have had discussions with camera vendors that would like to incorporate this technology directly into their hardware platforms once the algorithms have reached a sufficient state as to not require operator interaction. They are interested in the potential to automate the image enhancement techniques. We have also

Management Team *(cont.)*

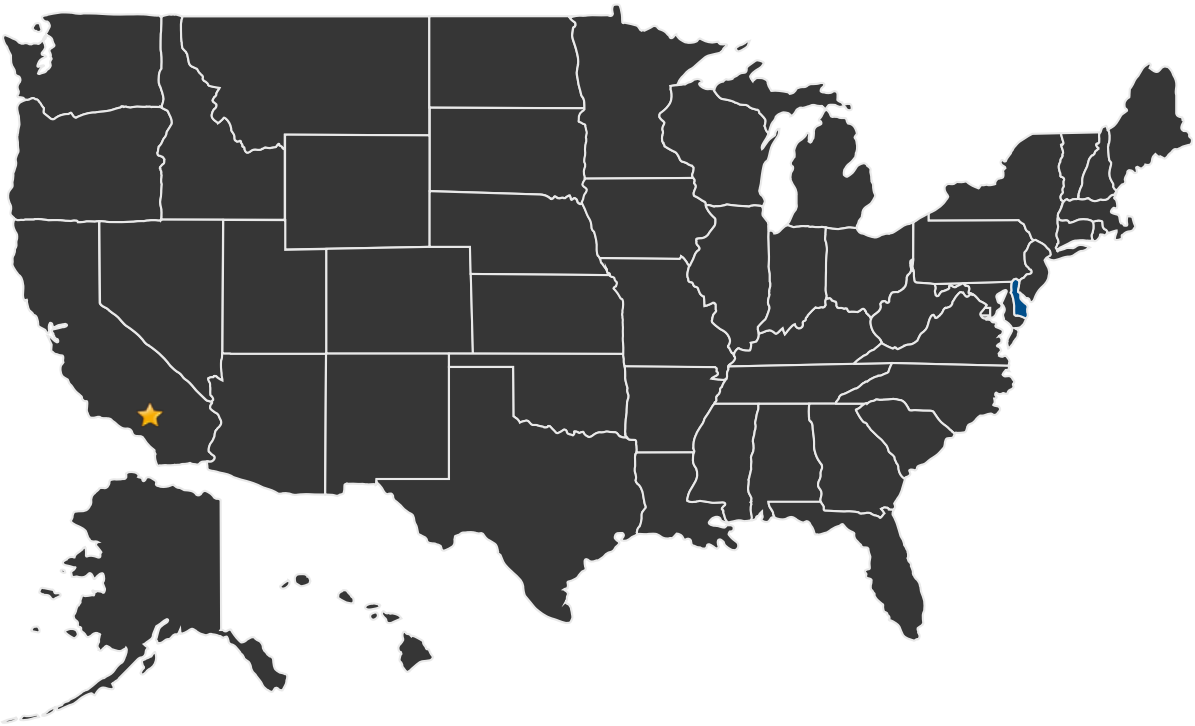
Principal Investigator:
- Aaron Paolini

Technology Areas

Primary Technology Area:
Science Instruments, Observatories, and Sensor Systems (TA 8)
└ Observatories (TA 8.2)

been approached by video production companies about using our tools in their processing pipeline. While some have used it successfully, they have expressed an interest in further automation of the tools. We see this as a group that could help sustain this work once this project is complete.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Armstrong Flight Research Center

Other Organizations Performing Work:

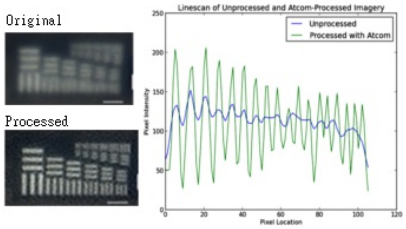
- EM Photonics, Inc. (Newark, DE)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23227)

IMAGE GALLERY



Automated Tools and Technologies for Enhancing Long-Range Imagery, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

Automated Tools and Technologies for Enhancing Long-Range Imagery, Phase I

Potential Applications

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